



Answer the following three questions:

Question 1:

(30 marks)

- With the aid of the three-schema structure, explain the concepts of logical and physical independence?
- Write the equivalent relational calculus expressions for each of the following relational algebra:
 - $\pi_{\text{Number}, \text{Name}, \text{Age}} (\sigma_{\text{Salary} > 40} (\text{EMPLOYEES}))$
 - $\tau_{\text{Number} = \text{SupNum}} (\rho_{\text{Number} \leftarrow \text{Name}, \text{Age} \leftarrow \text{Salary}} \text{EMPLOYEES}) \bowtie_{\text{Number} = \text{Head}} (\text{SUPERVISION} \bowtie_{\text{Employee} = \text{Number}} (\sigma_{\text{Salary} > 40} (\text{EMPLOYEES})))$
- Discuss the meaning of the following SQL query:

```
SELECT employee_id, last_name, job_id, &column_name
FROM Employees
WHERE &condition
ORDER BY &order_column;
```

- Given the following schema:

EMPLOYEES (RegNo, FirstName, Surname, Dept, Salary, City)

DEPARTMENT (DeptName, Address, City)

Write the SQL query statement for:

- Write a query that will display the difference between the highest and lowest salaries in each department.
- Display the employee number, name and salary for all employee who earn more than the average salary.

Question 2:

(30 marks)

- A database management system (DBMS) is a software system able to manage collections of data that are: *large*, *shared*, and *persistent*, and to ensure their *reliability*, and *privacy*. It also must be *efficient* and *effective*. Explain this assertion

- Given the following schema:

Salesman(Number, Name, Branch, Salary, Commission)

Write the SQL query statement for:

- Display the name, salary and commission for all salesmen who earn commissions. Sort data in descending order of salary and commissions?
- Find which branches spend more than 100 on salaries?
- Display the name and salary for all salesmen whose name begin with letter 'M' and their salary is not in the range of 45 and 65.

3. Consider the two relations given below. Find the SQL query and the outputs for each of the following:
- Find the drivers with their cars including the drivers without cars?
 - Find the cars with their drivers including the cars without drivers?
 - Find all the drivers with all the cars?

DRIVERS		
DriverID	FirstName	Surname
VR1000Y	Mosataf	Jalmy
PZ1000B	Samer	Mahmoud
AP1000R	AbdAllah	Aratu

AUTOMOBILE			
CarRegNo	Make	Model	DriverID
ABC123	BMW	323	VR1000Y
DEF456	BMW	Z3	VR1000Y
GHI789	TOYOTA	Yaris	PZ1000B
BBB421	BMW	316	MI1000U

Question 3:

(30 marks)

1. Create the STUDENT table based on the following table instance chart. Confirm that the table is created.

COLUMN NAME	ID	NAME	AGE
Default value	1	Not available	20
DATATYPE	Number	Varchar2	Number
LENGTH	7	25	12
CONSTRAINT	not repeated, not empty	repeated	repeated, check it is a positive

- a) Fill the STUDENT table with 4 tuples containing any data you need.
 - b) Add column Address to table STUDENT.
 - c) Move the table STUDENT to the recycle bin.
2. What is the **difference** between:
- WHERE and HAVING clauses.
 - Degree and cardinality of a relation.
 - Logical models and conceptual models.
3. With reference to the following database schema:
- CITIES**(Name, Region, Population)
CROSSING (City, River)
RIVERS (River, Length)
- Formulate the following queries in both Relational Algebra and SQL statements:
- Find the **names**, **regions** and **population** for the cities that have more than **50 thousand** in habitants and are crossed by the **Thames** or the **Mersey**
 - Find the **cities** that are crossed by (**at least**) two **rivers**, giving the name of the city and the **length** of the rivers.

*With my best wishes,
Dr. Dina M. Ibrahim*